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IS 10106-4-5 (1986): Packaging Code, Part 4: Packages, Section 5: Wood Based Containers [TED 24: Transport Packages]



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IS : 10106 (Part 4/Sec 5) - 1986

Indian Standard
PACKAGING CODE

“RE-AFFIRMED 1996”

PART 4 PACKAGES
Section 5 Wood Based Containers

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

PACKAGING CODE

PART 4 PACKAGES

Section 5 Wood Based Containers

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IS : 10106 (Part 4/Sec 5) - 1986

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PACKAGING CODE

PART 4 PACKAGES

Section 5 Wood Based Containers

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 May 1986, after the draft finalized by the Packaging Code Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 The packaging code is being issued in several parts as follows, each having one or more sections.

- Part 1 Product packaging
- Part 2 Packaging materials
- Part 3 Ancillary materials
- Part 4 Packages
- Part 5 Packaging operations
- Part 6 Storage and transportation
- Part 7 Packaging machinery

0.3 This part (Part 4/Sec 5) has been prepared to act as a guide to the manufacturers and users of all types of cases and crates where wood, plywood and other wood based articles are used. Some details of the packaging material based on wood and wood products are given in Part 2/Sec 5* of the code but some essential aspects are dealt with in this part, and references are given to the related Indian standards for greater details, if required.

0.4 Packing cases designed of solid wood are still in wide use by Government departments and some industries in areas where additional safety is required to meet the several types of transport hazards. However, with increasing shortage of timber, alternate designs with battened plywood construction are in vogue. These are characterised by light tare, strong

*Packaging code : Part 2 Packaging materials, Section 5 Wood and plywood (*under preparation*).

corners, resistance to puncture and distortion, resistance to racking, shock resistance, stability in stacking and ease of handling. Usually such articles as instruments, chemicals, machined parts, hardware, electronic equipment, tinned foodstuffs, tools, glassware and other delicate articles are packed in wood based containers. All types of contents are classified as 'easy load', 'average load' and 'difficult load' depending upon the nature of contents, protection required to the contents and also to the container during transport and storage. A list of existing standards on different types of containers is given in Appendix A.

0.5 In the preparation of this standard, assistance has been derived from the Defence Packaging Code and BS 1133 : Section 8-1981 'Packaging code wooden containers' issued by the British Standards Institution (BSI). Recommendations made in this code are also based on some surveys made in Indian industry and laboratory experiments carried out in India.

1. SCOPE

1.1 This section (Part 4/Sec 5) of the packaging code gives general guidance on use and design of crates and cases made of wood, plywood and wood based material.

NOTE — A knowledge of engineering principles is necessary to produce detailed design specifications from the information given.

2. TERMINOLOGY

2.1 For purpose of this part of the code, the following definitions in addition to those given in IS : 6703-1972* and IS : 707-1976† shall apply.

2.1.1 Braces — Single, double, triple or multiple diagonal members taking the form of an X or XX shape, fitted mainly to prevent racking (diagonal deformation) and to a lesser extent, to prevent puncture and compressive damage due to increase in total thickness.

2.1.2 Corner Posts — Formed by and at the interface between sheathing members. They are rarely separate components but are formed by vertical rail or a pair of vertical rails when constructing the case by joining sheathing elements.

2.1.3 Racking Resistance — Ability of a case to maintain its squareness when subjected to various forms of loads. This is essential for the protection of the contents.

*Glossary of wooden packaging terms.

†Glossary of terms applicable to timber technology and utilization (second revision).

2.1.4 Sills — Internally placed longitudinal timber. The alternative to skids where, for example, a machine's mounting points are not at its lowest part, that is, it has projections below its base.

3. CHOICE OF TYPE OF CASES

3.1 General — Information on the general factors to be considered when determining the broad choice of type of packing for given requirements is given in IS : 10106 (Part 1)-1982*. When wood based containers are to be selected, the information given in 3.2 and 3.3 is to be taken into account.

3.2 The choice of the required class and type of packing cases or crates made of wood and plywood depends on the following factors:

- a) Mass and nature of contents in relation to wood used;
- b) Types of load (*see* Appendix B);
- c) Handling and transportation systems to reach the destination;
- d) Storage, racking resistance, reusable needs and collapsible design;
- e) Effects of environment on wood based articles;
- f) Availability of wood species in the required zone, their properties and processing facilities;
- g) The scheme for nailing, screwing, metal edging and corner protections as required (*see* Fig. 1); and
- h) Ultimate economy of the case with reference to the cost of contents and protection required against damages.

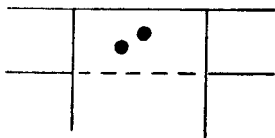
3.3 A knowledge of the required species under the required use, effects of normal defects present in the converted timber, plywood panels, battens etc is essentially required for design and choice of the cases and crates. A knowledge of other existing standards relating to other materials used in packing cases is also necessary (*see* Appendix C).

4. BASIC DESIGN FACTORS WITH WOOD AND PLYWOOD

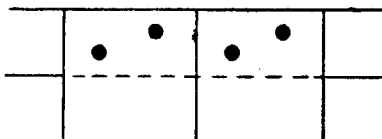
4.1 When designing with wood it should be remembered that in solid wood, the strength along the grain is nearly 20 times the strength across the grain and the same is more or less equalized in plywood. Some of the defects are to be completely avoided and some may be permitted with proper limits and in restricted locations which are described in detail in the concerned specifications. All timbers should be seasoned to the required moisture content to avoid warp, shrinkage, swelling, splitting, loosening of nails and other metal fixtures, and other drying defects. All

*Packaging code : Part 1 Factors affecting the selection of packaging.

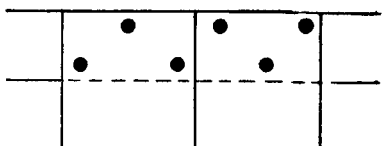
sapwood and non-durable timbers should be given proper preservation treatment to ensure the required durability and avoid termite or fungus attack (see Appendix C). Plywood or other wood based panels are used where single wide panels are required. The number of plies and the thickness of panels depends on the strength and stiffness required. Basic design data of the same is given in Appendix D.



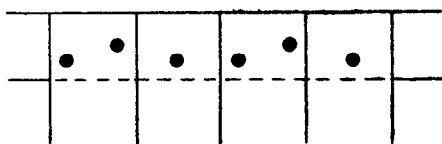
- (1) Poor resistance to racking movement



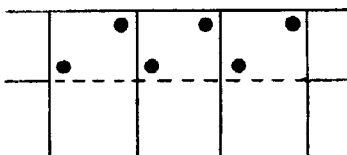
- (2) Develops maximum potential racking strength with two nails



- (3) Improved racking strength compared with (2)



- (4) Poor use of every other board in resisting movement



- (5) Probability of end cleaving when loaded owing to inadequate distance from edge

FIG. 1 EXAMPLES OF STAGGERED NAILING SCHEME

5. SELECTION OF TIMBER AND PANEL PRODUCTS

5.1 The guidelines and other details for selection of timber and panel products are covered in IS : 10106 (Part 2/Sec 5)*.

6. FASTENINGS

6.1 Fastenings such as nails, staples, metal edgings, metal strappings, etc, are important features of good and sound wooden containers. These are specified under respective standards with regard to their quality, diameters, thicknesses, lengths, etc (*see* Appendix D). Adhesives are rarely used for reasons of time and difficulties of quality control and inspection amongst solid wood containers. These are, however, used in joints and in the manufacture of plywood and particle board used in packing cases. Guidelines for using nails are generally prescribed in the individual specifications.

7. WOODEN CASES AND CRAFTS

7.1 For full details such as dimensions, styles, etc of wooden packing cases for general use for packaging of contents weighing not more than 250 kg, a reference may be made to IS : 1503-1979†. For details of wooden packing cases for packing of contents weighing upto 8 000 kg IS : 7960 (Part 1)-1976‡, may be referred. A list of Indian Standards relating to different types of wooden containers is given in Appendix A.

8. PLYWOOD AND OTHER TYPES OF CASES

8.1 For full details such as dimensions, types, etc of battened construction plywood cases, IS : 2674-1980§ may be referred. Indian Standards relating to other types of plywood cases are listed in Appendix A.

9. PACKING AND DUNNAGE

9.1 Dunnage is the necessary anchoring, blocking and bracing that together with cushioning (where required) assists in safe conveyance of packed goods. Fig. 2 shows two of the basic methods of preventing movement of contents when transporting or when the case is of the ' right side up ' configuration. With certain equipment it is essential that designers' information as to the correct support points is followed. If possible, cradles and dunnage should be attached to the base with allowance being made for the effects of base deflection. If possible, equipment should be bolted to the skids or sills. Figure 3 shows a typical method for fixing the contents to the skids.

*Packaging code : Part 2 Packaging materials, Section 5 Wood and plywood (*under preparation*).

†Specification for wooden packing cases (*second revision*).

‡Code of practice for packing machine tools : Part 1 For overseas shipment.

§Plywood cases-battened construction (*first revision*).

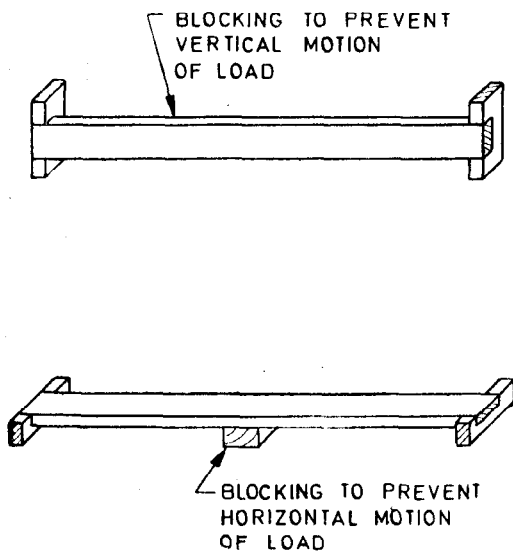


FIG. 2 BLOCKING METHODS

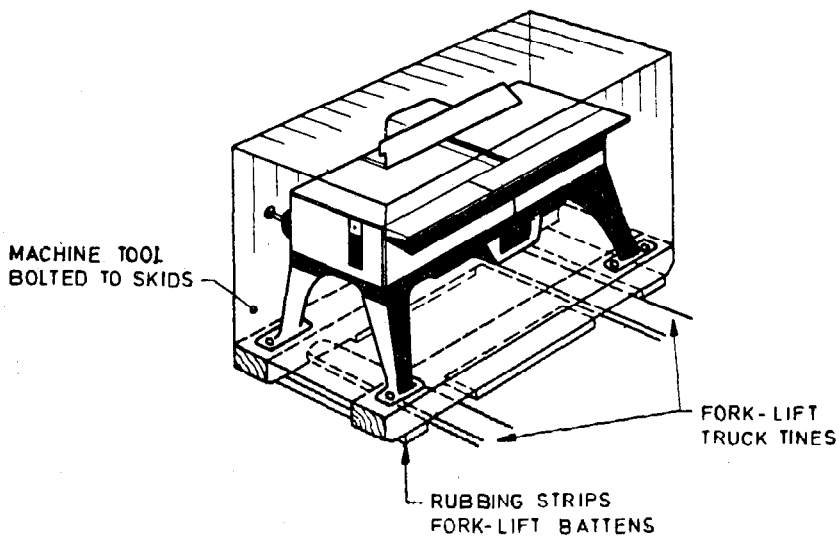


FIG. 3 TYPICAL METHOD FOR ATTACHMENT OF CONTENTS

10. HANDLING AIDS

10.1 General — As wood based containers may contain a variety of loads and may be of a variety of sizes, a number of handling aids may be used during transit cycles. These may be broadly classified as:

- a) The mechanical facility used, for example, fork lift truck;
- b) Special case features for correct use of aid, for example, rubbing strips; and
- c) Stencilled instructions to assist handlers, for example, 'LIFT HERE', etc.

As a first step in designing a case it should be known which of the normal mechanical aids are necessary, taking account of the goods in transit. A good design will assume a low standard of handling in transit and make it impractical for the undesirable facilities to be used. Provisions may be made for fork entry by cutting away skids and providing a tunnel (in which case compensation by increasing the thickness of the skid should be made) or alternatively, fork lift battens may be added underneath the skid.

11. TESTS

11.1 The various types of tests on wooden and plywood cases as mentioned below are described in detail in respective standards along with the required criteria for acceptance of different types of containers. A brief mention is made here for understanding the relative importance of the different tests. The normal tests are as follows. For full details of various types of test, reference may be made to IS : 8358-1977* and IS : 7028 (Parts 1 to 9)†.

11.1.1 Drop Test — This is done on filled cases for fixed heights or increasing heights on faces, corners and edges, and the criteria of acceptance depends on individual cases described in respective specifications. These are supposed to simulate some types of handling hazards and serve to evaluate comparative performance of different designs.

*Performance tests for wooden packing cases.

†Performance tests for complete, filled transport packages:

Part 1-1973 Stack load test.

Part 2-1973 Vibration test.

Part 3-1973 Horizontal impact test, inclined plane test and pendulum test.

Part 4-1973 Vertical impact drop tests.

Part 5-1973 Rolling test.

Part 6-1973 Compression test.

Part 7-1974 Low pressure test.

Part 8-1974 Water spray test.

Part 9-1975 Stacking test using compression tester.

11.1.2 Compression Test — This is done generally on unfilled cases subjected to compressive forces either on the opposite faces or diagonally opposite corners as may be desired. This helps in judging the comparative performance in stacking, storage and racking capacity.

11.1.3 Drum Test — This is done on filled cases on huge revolving hexagonal drums containing typical obstructions on internal surfaces of the drum to simulate collectively the transport hazards. These tests are particularly useful in examining the weak spots of any design and reinforcing the same in subsequent manufacture.

11.1.4 Hauling Test — This test, sometimes known as rolling test, is also carried on filled cases and is intended to judge performance of boxes in hauling or dragging on level surfaces.

11.1.5 Inclined Impact Test — This is done on filled cases over inclined planes to evaluate performance of cases which are likely to receive lateral impacts, such as encountered in railway wagon shunting, etc.

11.1.6 Vibration Test — The filled containers with or without stack load are placed on a platform which can be given vibration of given amplitude and frequency either horizontally or vertically or in combined motions to simulate transit conditions in moving vehicles. When the cases are subjected to these tests, the condition of the contents at the prescribed levels gives indication of protection given to the contents.

12. MARKING

12.1 Marking has a relevance to handling and is obligatory under the regulations. Unless otherwise specified, each assembled case or bundle of shooks shall be legibly and indelibly marked or stencilled, or otherwise sticker labels used with the following information:

- a) Manufacturer's name or initials or trade-mark, if any;
- b) Year of manufacture; and
- c) Class and style of the case which may be indicated by any agreed symbol or symbols for example C/S for class/style of IS : 1503-1979*.

*Specification for wooden packing cases (*second revision*).

APPENDIX A

(*Clauses 0.4, 7.1 and 8.1*)

STANDARDS ON SOLID WOOD CONTAINERS AND PLYWOOD AND OTHER TYPES OF CASES

A-1. LIST OF STANDARDS ON SOLID WOOD CONTAINERS

- IS : 1503-1979 Wooden packing cases (*second revision*)
- IS : 3071-1981 Wooden crates (*first revision*)
- IS : 3728-1966 Wooden boxes for packaging apples
- IS : 3805-1979 Pent-top wooden cases (*first revision*)
- IS : 7698-1983 Returnable wooden crates for vegetables (*first revision*)
- IS : 7960 (Part 1)-1976 Code of practice for packing machine tools:
Part 1 For overseas shipment
- IS : 8358-1977 Performance tests for wooden packing cases
- IS : 8725-1978 Wirebound wooden boxes
- IS : 8726-1978 Wirebound wooden crates
- IS : 9590-1980 Non-returnable wooden boxes for horticulture
produce
- IS : 10324-1982 Wooden crates for bottled drinks
- IS : 10402-1982 Pine-needle hardboard boxes for packaging of apples

A-2. LIST OF STANDARDS ON PLYWOOD AND OTHER TYPES OF CASES

- IS : 10 Plywood tea-chests
- IS : 10 (Part 1)-1976 General (*fourth revision*)
- IS : 10 (Part 2)-1974 Plywood (*fourth revision*)
- IS : 10 (Part 3)-1976 Battens (*fourth revision*)
- IS : 10 (Part 4)-1976 Metal fittings (*fourth revision*)
- IS : 10 (Part 5)-1976 Assembly and packing (*fourth revision*)
- IS : 2674-1980 Plywood cases—battened construction (*first revision*)
- IS : 7630-1975 Plywood drums
- IS : 7992-1976 Plywood cases for packing tobacco for export

APPENDIX B

(Clause 3.2)

TYPES OF LOAD

B-1. FACTORS

B-1.1 The prime factors influencing proper wooden packing case design are physical attributes of the load. These include the mass, size, fragility, shape and capacity for supporting the packing case. For the purpose of classifying the contents which may be packed in wooden packing case, three types of load categories have been defined. These are 'easy load', 'average load' and 'difficult load'.

B-2. EASY LOAD

B-2.1 Easy load consists of contents having low to moderate density and filling the inside of the packing case completely. The contents also consist of articles of sufficient strength to withstand the forces encountered in handling and transportation, and are of such a shape as to fully contact all faces of the packing case. Such items as boxed articles, chests or kits of tools and wooden cabinets are examples of this type of load.

B-3. AVERAGE LOAD

B-3.1 Average load consists of items which are moderately dense and which require a reasonable amount of protection. Items of this type may either be packed directly into the outer container or in an intermediate package which aids in supporting the faces of the outer container. The items themselves or their packages must provide a moderate amount of support for all faces of the packing case in order to be classified as an average load. In this group fall items in metal cans, bottles individually cushioned, hardware and numerous other items which are first packed in individual cartons.

B-4. DIFFICULT LOAD

B-4.1 Difficult load consists of items which are highly concentrated or require a high degree of protection. Items in this category furnish no support to the faces of the packing case but rather, in many instances, tend to apply concentrated forces to the packing case surfaces. Bolts, nuts and other dense items which are free to shift or flow, as well as delicate instruments, machined parts, valves and fittings, machine assemblies and accessories which have to be held in place by bracing and bolting; heavy wrenches which exert highly concentrated force on two opposite faces of the packing case and others which do not completely fill the packing case fall into this class.

APPENDIX C

(Clauses 3.3 and 4.1)

LIST OF ASSOCIATED STANDARDS USEFUL FOR WOOD BASED CONTAINERS

C-1. The list of associated standards useful for wood based containers is as follows:

- IS : 280-1978 Mild steel wire for general engineering purpose (*third revision*)
- IS : 303-1975 Plywood for general purposes (*second revision*)
- IS : 399-1963 Classification of commercial timbers and their zonal distribution (*revised*)
- IS : 401-1982 Code of practice for preservation of timber (*third revision*)
- IS : 707-1976 Glossary of terms applicable to timber technology and utilization (*second revision*)
- IS : 723-1972 Steel countersunk head wire nails (*second revision*)
- IS : 848-1974 Synthetic resin adhesive for plywood (phenolic and aminoplastic) (*first revision*)
- IS : 1029-1970 Hot rolled steel strips (baling) (*first revision*)
- IS : 1141-1973 Code of practice for seasoning of timber (*first revision*)
- IS : 1707-1979 Wood wool for general packaging purposes (*first revision*)
- IS : 4835-1979 Polyvinyl acetate dispersion-based adhesives for wood (*first revision*)
- IS : 4970-1973 Key for identification of commercial timbers (*first revision*)
- IS : 5247 (Part 2)-1983 Converted timber (coniferous) : Part 2 Packing cases and crates (*first revision*)
- IS : 5872-1973 Cold rolled steel strips (box strappings) (*first revision*)
- IS : 6662-1980 Timber species suitable for wooden packaging (*first revision*)
- IS : 6703-1972 Glossary of wooden packaging terms
- IS : 10106 (Part 3/Sec 1)-1984 Packaging code : Part 3 Ancillary materials, Section 1 Cushioning materials
- IS : 10106 (Part 3/Sec 3)-1985 Packaging code : Part 3 Ancillary materials, Section 3 Tensional strapping

APPENDIX D(*Clauses 4.1 and 6.1*)**MECHANICAL PROPERTIES/DESIGN DATA OF MATERIAL
USED IN WOOD BASED CONTAINERS****D-1.** Mechanical properties/design data of material used in wood based containers is given below:

a) Specific gravity of wood species	0.23 to 0.76.
b) Modulus of rupture of wood species	20 to 81 N/mm ² .
c) Modulus of elasticity of wood species	2.45×10^3 to 12.59×10^3 N/mm ² .
d) Compression strength	10 to 42.5 N/mm ² .
e) Comparative suitability	52 to 113.
f) Puncture resistance:	
9 mm plywood	5.3 kN
12 mm particle board	1.9 kN
19 mm particle board	2.8 kN
g) Safe working loads for horizontal beams (or bending members) and vertical battens (or compression members)	See Tables 1 and 2.

NOTE — In addition to the above properties, screw holding power, nail holding power and strength of plywood also play important role in design of packing cases.

TABLE 1 UNSUPPORTED FLOORING/TOP COMPONENTS : SAFE WORKING LOADS PRODUCING A MAXIMUM OF ONE PERCENT DEFLECTION OVER THE SPAN

LENGTH OF BOARDS	SAFE WORKING LOAD CARRIED BY A BOARD OF ONE METRE WIDTH FOR DIFFERENT THICKNESSES								APPRO- XIMATE DEFLEC- TION
	16 mm	19 mm	22 mm	25 mm	32 mm	38 mm	44 mm	50 mm	
(1) mm	(2) kg	(3) kg	(4) kg	(5) kg	(6) kg	(7) kg	(8) kg	(9) kg	(10) mm
1 000	366	600	933	1 367	2 900	4 800	7 467	10 933	10
2 000	93	153	233	346	713	1 200	1 865	2 733	20
3 000	40	67	103	153	267	433	800	1 200	30
4 000	25	42	65	97	169	274	560	706	40

NOTE 1 — Intermediate support given by skids or dunnage would increase the above SWL.

NOTE 2 — Table 1 assumes a high degree of built-in restraint at the ends of the top spanning boards as normally imparted by good construction.

TABLE 2 SUITABLE SIZES AND ALLOWANCE FORCES IN CRUSH BATTENS

SECTION SIZE	MAXIMUM ALLOWABLE FORCE IN CRUSH BATTENS OF DIFFERENT LENGTHS	
	1 m	2 m
(1)	(2)	(3)
mm	kN	kN
75 × 50	128	32
100 × 50	170	42
100 × 63	342	86
75 × 75*	432	108
100 × 75	544	136
100 × 100	1 360	340

*Not commercial metric standard size.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²